Convective Severe Weather

3c. Given charts and diagrams, analyze for convective severe weather parameters with at least 75% accuracy based on a master solution.

Operation

- SHARP is a very user friendly program that operates on any IBM or compatible PC Use of a mouse is not require but is recommended Without a mouse, the on-screen editing function is NOT available

Operation

- Procedures
  - **Step 1** At the DOS prompt, type CD\SHARP You will now be in the SHARP directory
  - **Step 2** At the DOS prompt, type SHED Here you are able to manually enter standard RAOB data Simply Follow on-screen instruction
  - **Step 3** Enter the data for all three sections of the sounding Type <F2> for TTAA or mandatory level data, <F3> for TTBB or significant level data, or <F4> for PPBB or wind data

Operation

- **Step 4** After all data is entered, type <ALT> F to access the file menu, or point and click using mouse and cursor
  - You have five options from which to select
  - Select NEW to enter data for a new Skew-T
  - SAVE to save the entered data
  - Load is to load data from another source
  - RUN SHARP enter the SHARP workstation
  - EXIT returns to DOS prompt

Operation

- **Step 5** At this point, after entering data, select SAVE
- **Step 6** Select RUN SHARP You are now in the SHARP workstation main menu
- **Step 7** From the main menu, select option 3, Database Management, Requests Macros, and Utilities
- **Step 8** You will now have a list of Skew-T's to choose from, hopefully including the one you entered
  - Using the arrow keys select the station you wish to analyze and forecast
  - The one being selected will be highlighted

Operation

- **Step 9** Once the desired Skew-T is highlighted, select <CTRL> A to load the data
  - Program will now plot and analyze both the Skew-T and hodograph
  - When the analysis is completed, SHARP will display the first page of data
  - From this point, make selections from the list at the bottom of the screen to view the plotted Skew-T or hodograph

Operation

- Editing a Skew-T
  - As stated earlier, SHARP allows for on-screen editing (provided mouse is installed) of both the Skew-T and hodograph Use the following steps to edit a Skew-T:
    - **Step 1** Place the pointer near the curve (either temperature or dewpoint) and pressure level that you wish to modify
    - **Step 2** Press and hold the left mouse button
    - **Step 3** Drag the pointer to the new temperature or dewpoint position

Operation

- **Step 4** Release the mouse button The program will re-plot that level and the Skew-T and automatically compute stability indices based on the new temperature/dewpoint

Operation

- Editing a Hodograph
  - **Step 1** For winds, type <F2> Wind data will appear in the bottom left corner, in the green box
  - **Step 2** Move the arrow up or down the list of winds to select the level you wish to edit The selected level will be highlighted
  - **Step 3** Press and hold the left mouse button The pointer will now appear on the hodograph
  - **Step 4** Move the arrow to the new desired position based on forecast wind speed and direction

Operation

- **Step 5** Release the mouse button The program will now re-plot the wind data for that level Repeat as necessary until all winds have been edited to your satisfaction
- **Step 6** Select exit The program will automatically the mean wind
- **Step 7** To edit storm motion, simply move pointer to desired position, press and release the left mouse button

Operation

- **EVALUATION: Written test**
  Stability Indices
  - Showalter Stability Index (SSI)
    - Use
      - SSI determines the potential thunderstorm intensity based on the existing air mass.
      - Not consider a trigger mechanism.
      - Plotted Skew-T is needed to compute this index.

Operation

- Procedure
  - Compute a LCL for the 850-mb level.
  - At the LCL, lift the parcel, parallel to the moist adiabat, to the 500-mb level.
  - Subtract this temperature from the observed 500-mb temperature.
  - The difference is the SSI.

Operation

- Lifted Index (LI)
  - Use
    - LI determines potential thunderstorm intensity based on the existing air mass.
    - Not consider a trigger mechanism.
    - Plotted Skew-T is needed to compute this index.
  - Procedures
    - Compute a LCL using the moist layer method (LCLml).
      - » Consider the lowest 100 mb of the sounding as being the moist layer.

Operation

- To compute the LCLml, find the mean mixing ratio for the lowest 100-mb of the sounding using the equal area method.
- Next, find the forecast maximum surface temperature.
- From this temperature, follow a dry adiabat upward until it intersects the mean mixing ratio.
- This is the LCLml.

– From the LCLml

- Lift the parcel upward, parallel to a moist adiabat, to the 500-mb level.
- Subtract this lifted 500-mb temperature from the observed 500-mb temperature.
- The difference is the LI.

Operation

- Total Totals
  - ***Use.***
    - The total totals (TT) determines the potential thunderstorm intensity based on the existing air mass.
    - Like the previous indices, the TT does **NOT** consider a triggering mechanism.
    - This index is also one of the easiest to compute.
      - » Skew-T is **NOT** required.
      - » You use a mathematical equation using the 850-mb temperature and dew point temperature, and the 500-mb temperature.

Operation

- The TT is actually a combination of two other indices. They are the vertical total (VT) and the cross total (CT). TT = VT + CT.
- ***Procedures.***
  - To compute TT, you need the 850-mb temperature (850T) and dew point temperature(850Td), and the 500-mb temperature (500T). As previously stated, the
  - TT = VT + CT.
    - » VT = 850T - 500T.
    - » CT = 850Td - 500T.
  - TT = (850T + 850Td) - 2(500T). Use chapter 7 in the Severe Weather Study Guide to determine stability.

Operation

- K-Index
  - ***Use.***
    - The K-index (KI) determines the potential of thunderstorm occurrence based on the existing air mass.
    - It does **NOT** consider a triggering mechanism.
    - Like the TT, the KI is relatively easy to compute.
      - » Skew-T is **NOT** required.
      - » Mathematical equation using the 850-mb temperature (850T) and dew point temperature (850Td), the 700-mb dew point depression (700DPD), and the 500-mb temperature (500T).

Operation

- ***Procedures***
  - Find the 850T, 850Td, 700 DPD, and 500T.
  - Use the equation:
    - » KI = (850T + 850Td) - (700 DPD) - (500T).
    - » Refer to Chapter 1 for K- Index values.

Operation

Hail Forecasting

- Use
  - The Fawbush-Miller hail forecasting technique determines the potential average hail size based on the existing air mass.
  - It does **NOT** consider a triggering mechanism.
  - This technique gives you an estimate of thunderstorm severity based on hail size.
  - A plotted Skew-T is required to compute hail size.

Hail Forecasting

- Hail Triangle Procedures
  - ***Step 1.***
    - Compute the convective condensation level using the moist layer (CCL_{ml}) method for the lowest 150 mb of the sounding.
    - Regardless of moisture content, consider the lowest 150 mb a moist layer.
    - To compute the CCL_{ml}, find the mean mixing ratio for the lowest 150 mb of the sounding using the equal area method.
    - Follow this mean mixing ratio line upward to the point where it intersects the temperature curve.
    - This is the CCL_{ml}.

Hail Forecasting

- Label this point as point A.
- Draw a reference line to the right of this point, parallel to the isobars, at the same pressure level.

– ***Step 2.***

- Find the point on the temperature curve where the temperature is -5^{o}C.
- Label this point as point B.
- Draw a reference to the right of point B, parallel to the isobars, at the same pressure level.

Hail Forecasting

- ***Step 3.***
  - From the CCL_{ml} (point A), trace a moist adiabat upward until it intersects the reference line of point B.
  - Label this intersection as point B'.
- ***Step 4.***
  - Algebraically subtract point B (which will always be -5) from the temperature at point B'. B' - (-5) or B' + 5.
  - This is the base of the hail triangle.

Hail Forecasting

- ***Step 5.***
  - At the reference line for point B, find the point where the reference line intersects the 0◦C isotherm.
  - Label that point as point H.
  - From point H, extend a line down, parallel to a dry adiabat, until it intersects the reference line from point A.
  - Label this point as point H'.
- ***Step 6.***
  - Algebraically subtract point H (which is 0) from point H'.
  - H' - 0.
  - This is the altitude of the hail triangle.

Hail Forecasting

- ***Step 7.***
  - Enter the values for the base and altitude of the triangle into the graph.
  - This will give you an uncorrected hail size.
  - To determine whether a correction is or is not necessary, you must compute the wet bulb zero height.

Hail Forecasting

Wet Bulb Zero Height Procedures

- Use.
  - The wet bulb zero (WBZ) height determines the need for and amount of correction needed for hail size computed by the Fawbush-Miller hail forecasting technique.
  - If a WBZ of 10,500 feet or greater exists, then you need to correct the hail size.

Wet Bulb Zero Height Procedures

- Procedures.
  - ***Step 1.***
    - Construct an LCL for a few pressure levels above and below the dry-bulb freezing level.
    - Insure that you do **NOT** skip any plotted pressure levels.
  - ***Step 2.***
    - From the LCL, follow a moist adiabat down to the original pressure level.
    - Follow this procedure for each pressure level.
    - This gives you the wet-bulb temperature for that level.

Wet Bulb Zero Height Procedures

- ***Step 3.***
  - Connect all computed wet-bulb temperatures.
  - This is the wet-bulb temperature curve.
- ***Step 4.***
  - Find the point where the wet-bulb temperature intersects the 0°C isotherm.
  - This is the WBZ height.
  - Extend a line parallel to the pressure level of this point to the right until it intersects the altitude scale of the Skew-T/Log P diagram.

Wet Bulb Zero Height Procedures

- This is your uncorrected WBZ height. To correct the height, simply subtract the station elevation from this height.
- If the WBZ height is below 10,500 feet, no correction is necessary.
- If the WBZ is 10,500 feet or above, enter the WBZ height of the WBZ and the uncorrected hail size determined earlier onto the graph.

- This will give you the corrected hail size that has taken melting into account.

Forecasting Maximum Wind Gusts (T_1 METHOD)

- Use
  - The T_1 method determines a reliable maximum average and maximum peak gust from thunderstorms originating from the existing air mass.
  - It does **NOT** consider a triggering mechanism.
  - This technique is useful for determining severe thunderstorm potential based on convective gusts only.

Forecasting Maximum Wind Gusts (T_1 METHOD)

- Procedures
  - Inversion Present
    - To use this method, the top of an inversion must be present in the lowest 200-mb of the surface.
      - The inversion must **NOT** be susceptible to being broke by surface heating.
      - To determine if surface heating will break the inversion (12Z Skew-T only), locate the warmest temperature in the inversion.
      - Next, locate the 850-mb temperature. At the 850-mb temperature, follow a dry adiabat down to the surface.

Forecasting Maximum Wind Gusts (T_1 METHOD)

- If the warmest temperature is on the cold side of this adiabat, it is subject to being broken by surface heating.
- If it is on the warm side of this adiabat, then it is **NOT** subject to being broken by surface heating.
- For the 00Z Skew-T, since no further surface heating will occur, any inversion, with the top in the lowest 200-mb of the sounding, will **NOT** be broken.

• ***Step 1.***

- Locate the warmest temperature in the inversion.
- Follow this point up a moist adiabat to the 600-mb level.
- Label this point as point T'. The 600-mb temperature is point T.

Forecasting Maximum Wind Gusts (T_1 METHOD)

- ***Step 2.***
  - Subtract point T from the temperature at point T' (T' - T).
  - This will give you the T_1 temperature.
- ***Step 3.***
  - Enter the T_1 temperature on the table.
  - This is the maximum average gust.

Forecasting Maximum Wind Gusts (T_1 METHOD)

- ***Step 4.***
  - To find the maximum peak gust, find the average wind speed for the lowest 5000 feet of the sounding by adding all of the wind plots together and dividing by the number of plots used.
  - Add one third of this average wind speed to the maximum average gust.

Forecasting Maximum Wind Gusts (T_1 METHOD)

- Procedures - No Inversion Present
  - Use this method if no inversion is present, the top of the inversion is above the lowest 200-mb of the sounding, or the inversion is subject to being broken by surface heating.
    - ***Step 1.***
      - » Forecast the maximum surface temperature. To do this, find the 850-mb temperature.
      - » From that point follow a dry adiabat down to the surface pressure level.
      - » This is the forecast maximum surface temperature.

Forecasting Maximum Wind Gusts (T_1 METHOD)

- ***Step 2.***
  - » From the forecast maximum surface temperature, follow a moist adiabat up to the 600-mb level.
  - » Label the intersection point as point T'.
  - » The 600-mb temperature is point T.
- ***Step 3.***
  - » Subtract point T from the temperature at point T' (T' - T).
  - » This gives you the T_1 temperature.

Forecasting Maximum Wind Gusts (T_1 METHOD)

- ***Step 4.***
  - » Enter the T_1 temperature on the table.
  - » This is the maximum average gust.
- ***Step 5.***
  - » To find the maximum peak gust, find the average wind speed for the lowest 5000 feet of the sounding by adding all of the wind plots together and dividing by the number of plots used.
  - » Add one third of this average wind speed to the maximum average gust.

850-mb ANALYSIS

- The 850-mb chart is a very important chart since it enables the forecaster to estimate stability of the atmosphere and helps to forecast changes in stability.
  - Use symbols as shown in this text to identify the described features.
  - The features that you must analyze for will me marked with an asterisk (*).

850-mb ANALYSIS

- Maximum Wind Bands* and Streamlines*
  - Maximum wind bands (jets) are important features because they are the transport mechanism for moisture and thermal advection.
  - This maximum wind band will be referred to as the low-level jet (LLJ). There is no speed criteria for the LLJ, it is simply a maximum band of winds as compared to the overall wind field.
  - You will also analyze for significant streamlines to assist in locating other areas of moisture and thermal advection.

850-mb ANALYSIS

- One of the primary reasons, however, for analyzing significant streamlines is to aid in identifying convergence zones.

850-mb ANALYSIS

- Thermal Field*
  - A detailed thermal analysis of the thermal field will correctly locate the thermal ridge.
  - Analyze isotherms for every 2C^{o}. Select an even number isotherm which forms a continuous band across the entire chart as your starting point.
  - A good analysis will require many erasures and adjustments from start to finish.
  - While analyzing the isotherms, remember that you are looking for the thermal ridge, not just drawing isotherms.

850-mb ANALYSIS

- A thermal ridge exists where the isotherms ridge outward from warm toward cooler temperatures. All thermal ridges are significant in the severe analysis, so do **NOT** ignore a thermal ridge, no matter how small it may seem.

850-mb ANALYSIS

- Moisture Analysis*
  - ***Isodrosotherms.****
    - Isodrosotherms are lines of equal dew point.
    - Analyze isodrosotherms starting with the +6^{o}C dew point.
    - This is the minimum dew point temperature shown to be capable of supporting severe thunderstorm development.
    - Continue the analysis with increasing dew points at 2C^{o} interval.
    - When drawing isodrosotherms, remember that you analyzing for the axes of maximum moisture and the axes of maximum moisture advection.

850-mb ANALYSIS

- ***Areas of Significant Moisture.***
  - The remainder of the significant moisture field is the area where the temperature-dew point spread is 6C° or less, outside of the area covered by the 6°C isodrosotherm.

- Dry lines (Dry Intrusion)
  - Dry lines on the 850-mb analysis are areas where the streamline flow is from dry air into areas of significant moisture.

850-mb ANALYSIS

- FIELD OF ANALYSIS PARAMETERS COLOR CODES AND SYMBOL (COMPOSITE)
  - Streamlines
    - Axis of maximum wind band (jet) Red
    - Significant streamlines
      Red
    - **Convergence zones
      Red

850-mb ANALYSIS

- Thermal
  - Isotherms (even number with 2C° interval.) Red
  - Thermal ridges Red
- Significant Moisture
  - Isodrosotherms (dewpoints of $\geq$ 6°C, 2C° interval.) Green
  - **Scalloped areas (dewpoint depression of $\leq$ 6C°.) Green
  - **Significant drylines Green
  - Axis of maximum moisture advection. Green

850-mb ANALYSIS

- Axis of maximum moisture Green

700-mb ANALYSIS

- Maximum Wind Band* and Streamlines*
  - Maximum wind bands (jets) are important features because they are the transport mechanism for dry intrusion.
  - This maximum wind band also indicates the areas of the most rapid cold- and warm-air advection.
  - A thermal analysis may also be necessary.
  - There is no speed criteria for the maximum wind band, it is simply a maximum band of winds as compared to the overall wind field.

700-mb ANALYSIS

- You will also analyze for significant streamlines to assist in locating other areas of dry intrusion and difluence.
- They are **NOT** necessarily maximum wind bands.

700-mb ANALYSIS

- Temperature Falls and No-Change Line
  - Temperature falls should be analyzed 12-hour falls from late fall through early spring, and 24-hour from late spring through early fall.
  - Analyze the temperature falls to indicate areas of cold-air advection.
  - Use the temperature falls analysis to identify the temperature no-change line.
  - The temperature no-change line helps identify the approximate position for squall line development.

700-mb ANALYSIS

- Thermal Analysis
  - You will use the thermal analysis to locate the areas of thermal troughs and ridges.
    - Analyze isotherms for every 2C°, starting with an even numbered temperature that forms a continuous band across the entire chart.
    - This forms a first guess of the thermal pattern.

700-mb ANALYSIS

- Keep in mind that you are **NOT** simply drawing isotherms, but are looking for thermal troughs and ridges.
  - The thermal ridge becomes important early spring through late fall.
  - During this time, the thermal "cap" may form.
  - This cap inhibits thunderstorm development.
  - The temperature that marks the cap varies from +8°C during early spring to +12°C during the summer and early fall, decreasing to +8°C again in late fall.

700-mb ANALYSIS

- Use the current or previous 500-mb analysis to aid in vertical stacking of the cold troughs.
- Use the previous 700-mb analysis to insure continuity of movement of the troughs.
- Thermal troughs assist in locating the most probable areas of vertical motion.

700-mb ANALYSIS

- Moisture Analysis* and Dry Intrusion*
  - Significant moisture fields are those areas where the temperature-dew point spread is 6C^{o} or less.
    - Detached areas of moisture that do **NOT** appear to be due purely to advection from a primary moisture source region is most likely a result of vertical motion.
    - This may indicate that a major or minor short-wave trough is a short distance upstream.
  - After identifying the areas of significant moisture, identify all areas of dry intrusion. Dry intrusion exists whenever the streamline flow crosses from dry into moist air.

700-mb ANALYSIS

- FIELD OF ANALYSIS PARAMETER COLOR CODE AND SYMBOL
  - Streamlines
    - Axis of maximum wind band (jet). Brown
    - Significant streamlines Brown
    - **Divergence zones Brown

700-mb ANALYSIS

- Thermal
  - **Isotherms (even number, 2C° interval.) Red
  - **Thermal (cold) troughs Blue -
  - If used on composite Brown.
  - **24 hr temperature change line Brown
- Significant Moisture
  - Scalloped areas Green
  - Dry intrusion Brown

500-mb ANALYSIS

- Maximum Wind Band*, Streamlines*, Difluence*, and Speed Shear
  - Maximum Wind Bands.*
    - Maximum wind bands (jets) are important features because they are the transport mechanism for cold-air advection.
    - This maximum wind band also outlines the possible severe weather areas.
    - There is no speed criteria for the maximum wind band, it is simply a band of maximum winds compared to the overall wind field.

500-mb ANALYSIS

- Significant Streamlines and Difluence.*
  - Significant streamlines are not necessarily maximum wind bands.
  - These streamlines assist you in identifying areas of difluence.
  - Sketch all significant streamlines indicating diffluent flow patterns.
- Horizontal Speed Shear.
  - A rapid decrease in the speed of flow to the right of the jet.
  - In the same direction depicts a horizontal speed shear zone.

500-mb ANALYSIS

- Thermal Field*, Cold Pools/Troughs*
  - Analyze isotherms at 2C° intervals.
    - Beginning with an even numbered isotherm that across the entire chart.
    - This gives you a first guess of the thermal pattern.
  - While analyzing the thermal field, remember that you are looking for cold pools and troughs at the 500-mb level. These aid in identifying the position of major and minor short-wave troughs at this level.

500-mb ANALYSIS

- Moisture Field
  - Significant moisture field is the area where the temperature-dew point spread is 6^{o}C or less, or where the dew point is -17^{o}C or greater.
  - Detached areas of moisture **NOT** explainable by pure advection from a primary moisture source region may indicate an area of vertical motion.

500-mb ANALYSIS

- Height Falls*
  - Height falls at the 500-mb level furnish a clue to the location and movement of long- and short-wave troughs.
  - They also approximate the area of maximum positive vorticity.
  - Since there is a seasonal difference in the frequency of migratory waves, 12-hour height falls should be used from late fall through early spring and 24-hour height falls should be used from late spring through early fall.
  - Use 30 m intervals starting with -30 m.

500-mb ANALYSIS

- FIELD OF ANALYSIS PARAMETER COLOR CODE AND SYMBOL
  - Streamlines
  - Axis of maximum wind band (jet) Blue
  - Significant streamlines Blue
  - Divergence zones Blue
  - *Speed shear zones Blue

500-mb ANALYSIS

- Height
  - 24 hr Height falls (with 30 meter interval.) Blue
- Thermal
  - Isotherms (even number, 2C° interval.) Red
  - Thermal (cold) troughs Blue
  - Cold pockets/pools Blue

500-mb ANALYSIS

- Significant Moisture
- **Scalloped areas (dewpoint depressions of $\leq 6C^{o}$) Green
- On a Composite Blue

300-mb ANALYSIS

- Isotachs*
  - Isotachs are lines of equal wind speed.
  - They are drawn at intervals of 30 knots for speeds of 60 knots or greater during the cold season, and 20 knot intervals for speeds of 40 knots or greater during the warm season.
  - Isotachs will assist you in identifying the maximum wind band.

300-mb ANALYSIS

- Maximum Wind Band* and Streamlines*
  - Analyze for the maximum wind band (jet).
  - The maximum wind band is important because it acts as the exhaust mechanism for thunderstorm development.
  - Speed criteria does **NOT** exist for the 300-mb analysis in severe weather.
  - You are looking for both the polar front jet and other maximum wind bands.

300-mb ANALYSIS

- The maximum wind band is simply an area of stronger winds as compared to the overall analysis.
- Analyze other significant streamlines to aid in identifying diffluent zones.

300-mb ANALYSIS

- Difluence*, and Speed Shear
  - Diffluent zones exist where there is significant branching of the flow, not necessarily along the maximum wind band.
  - A rapid decrease in the speed of flow to the right of the jet, but moving in the same direction depicts a horizontal speed shear zone.
  - They originate at the axis or edge of the maximum wind band.

300-mb ANALYSIS

- FIELD OF ANALYSIS PARAMETER COLOR CODE AND SYMBOL
  - Streamlines
    - Axis of maximum wind band (jet) Purple
    - Significant streamlines Purple
  - Divergence zones Purple
  - **Significant speed shear Purple
  - Isotachs Purple

SURFACE CHART ANALYSIS

- The surface chart is the most important chart that you have to analyze due to the frequency of availability and density of reporting stations as compared to the upper air charts.
  - The surface chart works well in tracking synoptic and meso-scale triggering mechanisms.
  - The parameters that you must analyze for are marked by an asterisk (*).

SURFACE CHART ANALYSIS

- Isobars*
  - Analyze isobars every 2 mb, starting with an even numbered isobar that extends over the entire chart.
  - This gives you a first guess of the overall pressure pattern.
  - If necessary to identify meso-scale highs (bubble highs) or meso-scale lows, a 1 mb analysis may be accomplished.

SURFACE CHART ANALYSIS

- Fronts*, Troughs*, Squall Lines*, and Pressure Centers*
  - After the isobaric analysis, identify all fronts, troughs, highs, and lows that you find.
  - Use appropriate colors and symbols.

SURFACE CHART ANALYSIS

- Drylines*
  - Drylines exist mainly along the lee side of the Rocky Mountains through western Texas and Oklahoma, but in extreme cases, may extend as far north as Nebraska and South Dakota.
  - A dryline exists in these areas when there is a dew point difference of 10F^{o} or more over a relatively short distance.
  - The 55^{o}F isodrosotherm will assist you as a first guess position for the dryline.

SURFACE CHART ANALYSIS

- Thunderstorm Outflow Boundaries*
  - An outflow boundary exists with all thunderstorms.
  - When you identify that a thunderstorm exists over a station, assume that the outflow boundary is present unless you have absolute proof that it does not yet exist.
- Isodrosotherms*
  - Analyzing isodrosotherms at 5F^{o} intervals for dew points of 55^{o}F and greater. This value is important because it appears to be the lowest value capable of supporting tornadic thunderstorms.

SURFACE CHART ANALYSIS

- FIELD OF ANALYSIS PARAMETER COLOR CODES AND SYMBOLS
  - Isobaric Analysis - Isobars (2 mb interval, even numbers)
    Black
  - Fronts
    - Cold Blue
    - Warm Red
    - Occluded Purple

SURFACE CHART ANALYSIS

- Squall lines Black
- Troughs Black
- Drylines Brown
- Outflow boundaries Blue

– Pressure Centers

- Synoptic highs Blue
- Mesoscale highs Blue
- Synoptic lows Red
- Mesoscale lows Red

SURFACE CHART ANALYSIS

- Streamlines - Bands of strong winds** Red
- Thermal
  - **Isotherms (5F^{o} interval) Red
  - **Thermal ridges Red
- Moisture
  - Isodrosotherms (start with 55^{o}F, every 5F^{o}) Green
  - **Axis of maximum moisture advection Green
  - **Axis of maximum moisture Green

Forecast criteria for CONUS Military Weather Advisory (WWUS) KGWC)

- Issued 4 times daily, valid for 12 hours
- Forecast areas are delineated by color codes
- MWA's should be used as only one tool in the severe weather forecast
  - Forecast should be base upon individual evaluation
  - Ensure you can support your reasoning before forecasting against MWA guidance
  - Discuss differences with the Global Weather Central Duty Officer (GDO)

- APPLICATION: Students will practice on appraisal packages in class.
- EVALUATION: A written measurement and progress check will be given at the end of the unit.